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August 9, 2012

Mr. Saul Bloom
Arc Ecology
4634 Third Street
San Francisco, CA 94124

Re: Independent Technical review of the Navy's Draft Record of Decision on Parcel E2 at the Hunter's Pont Naval Shipyard

Dear Mr. Bloom:

At your request, I performed an independent radiological review of the Navy's Draft Record of Decision (ROD) regarding the proposed remedy for parcel E2 at the Hunter's Point Naval Shipyard. The documents reviewed, besides the draft ROD itself, included the Remedial Investigation/Feasibility Study (RI/FS) prepared by Engineering/Remediation Resources Group, Inc and the Radiological Addendum to the RI/FS; and the Historical Radiological Site Assessment (HRA) performed by the Navy in 2004 as it is referenced as a key resource for the Radiological Addendum.

I performed this review from the perspective of best practices in the area of radiation protection of workers at Hunter's Point, the public around the facility, and the environment. My analysis and comments below are largely related only to the landfill. The panhandle area, the shoreline, and the adjacent areas will all be remediated and surveyed as part of the Navy's proposed remedy. Essentially all radioactive material above the remedial action goals has been or will be removed from these areas prior to any capping or any other restoration activities taking place. These actions are appropriate in my opinion and need no further review or comment

General comments:

In general, it is considered a poor practice to leave a waste site sitting in groundwater. From discussion with the independent review team's landfill expert, there are many such sites (approximately 15) around San Francisco Bay. From a radiological perspective, there does not appear to be an issue at this time since no radioactive material above background levels is currently being detected in the groundwater monitoring system. It should be noted that radium is highly mobile in salt water. Detection of radium in the groundwater above the current background levels should be investigated since it could indicate degradation of the radium contaminated articles buried in the landfill.

There is a discrepancy between the RI/FS Radiological Addendum and the Draft ROD on the remedial action goals. The Radiological Addendum shows the remedial action goal for Radium-226 as 1pCi/gm above background. The ROD shows the remedial action goal as 1 pCi/gm and does not include the footnote showing that remedial action goal is above background. It may not be possible for the Navy to find soil that is below 1 pCi/gm of Radium-226.

Specific Comments

1. Applicability of the EPA Presumptive Remedy

The EPA defines a municipal landfill as one with a heterogeneous mixture of municipal, industrial, and hazardous waste as quoted from EPA Guidance here:

> "Waste in CERCLA landfills usually is present in large volumes and is a heterogeneous mixture of municipal waste frequently co-disposed with industrial and/or hazardous waste."

Based on my review of the information presented in the RI/FS, the Radiological Addendum to the RI/FS, and the Historical Radiological Assessment (HRA), there was no indication of any material disposed of in the landfill that would not fit in the definition of a CERCLA landfill. Radiological Waste is not excluded from these landfills, and in fact highlight 3 of the guidance document specifically mentions low level radioactive waste in military landfills as being no more hazardous than other types of waste disposed in these landfills. Only low level radioactive waste was mentioned as being disposed of in the landfill in any of the documents.

There was a mention of sandblast waste from decontamination of ships used in nuclear weapons testing in the Pacific. However, this testing was largely completed before the landfill was in full operation as shown by the 1955 aerial photo. Most sandblast waste generated after this period would have been for removal of contaminants, such as biological and rust, rather than radiological.

Conclusion: The application of the presumptive remedy is a technically defensible conclusion based on the information provided.

2. Adequacy of the landfill characterization from a radiological perspective

This determination must be made in light of the presumptive remedy. The guidance document (Section 1) specifically limits characterization to those areas where migration is expected such as leachate or erosion. As such, the Navy has concentrated the characterization on the surface of the parcel and on the groundwater in and around the landfill. The Navy admits that the subsurface waste has not been characterized and relies on the information in the HRA to show that the waste is low level and in limited volume.

The surface characterization data is extensive. However, it was performed after the interim cap was placed following the landfill fire in 2000. This cap was constructed from imported fill material. This fill material has Radium-226, Cesium-137, and Strontium-90 contamination that exceed the remedial action goals as published by EPA and quoted by the Navy for this area. The source of this material has been identified as coming from various excavations around the Bay area. None of the excavations would be expected to have radioactive material at levels exceeding background. Although this cap is well characterized, it does not give any information as to the waste underneath the surface. Given that the levels and extent of the radium contamination is extensive and consistent across the interim cap and in all soil samples collected, it is likely that

the entire cap will need to be removed in order to meet the proposed remedial action goals. The cesium contamination would also be considered extensive as it shows up in 46 samples across the entire E2 parcel. Since the cesium contamination appears randomly throughout the cap, it is likely to be randomly detected in the remainder of the cap as well. The strontium cannot be directly measured and is a calculated value based on the cesium contamination detected. It is also likely that strontium contamination is present throughout the parcel and the interim cap.

The Navy has proposed removal of the top foot of the interim cap, followed by a resurvey of the remaining six inches of the interim cap and the top six inches of the landfill surface. This proposed remedy requires remediation of any areas exceeding the remedial action goals. Based on the sample data shown above, it is unlikely that the remaining six inches of the cap will be any different and will not need to be removed as well. This will allow a good characterization of the landfill surface.

As noted, the Navy has not performed any subsurface characterization of the landfill itself. Credit has been taken for radiological material found in other excavations when performing early removal actions for chemical contamination and when digging test pits to determine waste extent. The Navy has also quoted the HRA for the landfill as follows from 8.3.5.28:

> Former Uses: Landfill used from 1940s to 1974 for disposal of industrial and solid wastes; domestic wastes and refuse; building construction and demolition wastes; dredge spoil materials; sandblast waste; shop industrial, chemical, and solvent wastes; ship solid and liquid wastes from repair activities; and radioluminescent devices, primarily containing Ra-226. Potentially used for disposal of wastes from decontamination of OPERATION CROSSROADS ships.

The known information regarding subsurface contamination was extensively discussed in the RI/FS Radiological Addendum (Section 4). The Navy's discussion can be summarized as there is known subsurface contamination, primarily contaminated devices, contaminated industrial debris such as firebrick, contaminated laboratory waste, and other low level radioactive waste.

Conclusion:

The surface of parcel E2 is well characterized from a radiological perspective and the proposed remedy is adequately designed to address and remediate any radiological anomalies at or near the surface. In particular, the interim cap will likely need to be removed in its entirety and the surface of the landfill be resurveyed and characterized (and anomalies remediated) prior to placing of the final cap.

The subsurface of parcel E2 has not been characterized. However, in accordance with the guidance provided with the presumptive remedy, complete characterization is not required. Based on the information provided, I can conclude that the following types of contamination are likely present:

- Contaminated articles such as ships instruments and artifacts containing both Radium-226 and Strontium-90. Both isotopes are in solid form and would not be expected to be mobile, or

if the article was damaged, would only be expected to have limited local soil contamination. This has been noted in early removal efforts for chemical contamination where these articles have been encountered.

- Contaminated industrial debris such as firebrick. Firebrick has been encountered in early removal efforts for chemical contamination. Firebrick contamination would not spread and is comprised of naturally occurring radioactive material, primarily uranium and thorium.

- Contaminated laboratory waste, likely what would be considered dry active waste such as gloves, smear material, paper, lab supplies, etc. There may be localized contamination from contaminated sewer and storm drains. These drain lines are being removed and remediated as part of a separate removal action. Based on the HRA and Addendum, contaminated animal carcasses are not expected; however, it is likely that animal carcasses were disposed of in the landfill.

- Sandblast waste from Operation Crossroads is not expected to be present. This effort ended in 1951, well before the landfill began accepting significant volumes of waste as referenced by the 1955 aerial photograph. Sandblast waste is expected to be found, but is expected to have little if any radiological contamination based on the records presented.

3. Adequacy of the Radiological Characterization with Regards to Radiological Risk

Radiological risk is based on exposure to the radioactive material. Unlike chemical exposure, exposure to radioactive material does not have to occur through inhalation, ingestion, or absorption. Radioactive material also emits radiation which can be a direct exposure hazard.

The Navy's proposed remedy reduces the risk from surface radioactive material by removing all material above the remedial action goals and then providing for the application of a barrier and clean fill material. This prevents direct contact with any residual material and provides significant shielding to reduce exposure to radiation from remaining material.

The proposed remedy also reduces the risk from subsurface radioactive material as it provides for additional clean shielding material. It should be noted that in 1991, a surface survey of the landfill noted that there were no areas above background on the landfill. This would indicate that there were no anomalies in the landfill that were emitting any significant radiation fields at that time. The landfill stopped accepting waste in 1974, and not other intrusive activities other than removal have been documented since the landfill closed. With no radiation fields on the surface, there is no radiation exposure, and the clean fill prevents any direct contact with any residual radioactive material.

The Navy has calculated a risk of $2x10^{-8}$ once the proposed remedy is in place. This risk is well below the EPA threshold of $1x10^{-6}$ of being acceptable and $1x10^{-4}$ for when action is required.

Conclusion: The proposed remedy bounds the radiological risk regardless of whether the characterization of the landfill is adequate.

4. Risk of Landfill Removal

From a radiological standpoint there are two aspects of risk, to the workers, and to the public from transportation. Risk from disposal of the radioactive material at a licensed disposal facility is not addressed as those risks have already been addressed as part of the siting and licensing of the facility.

There is an inherent difficulty in performing a detailed risk assessment from a radiological perspective. The landfill has not been characterized below the surface and as such, it is impossible to quantify the exact hazards that may be encountered. However, given the bounding conditions as described in the HRA and the addendum, assumptions of relative risk can be made.

Radiological risk to workers is expected to be low based on the types of waste expected. Contaminated articles such as ships instruments do not have significant dose rates. Contaminated debris such as fire brick do not exhibit removable contamination that would be difficult to contain. Contaminated dirt is dealt with on a daily basis at many DOE sites and other remediation sites and does not represent a significant hazard to the workers. Standard worker protective equipment would be required, but would likely be required in order to protect the workers from the chemical contamination anyway. Any radioactive material that is wet would require impermeable clothing, but that would also be required when dealing with much of the chemical contamination. Based on my experience, this would be standard radiological work practices at many remediation sites and would not present any unusual or difficult radiological hazards.

Radiological risk to the public during transportation of the waste can be mitigated through a number of means. First, given the types of waste expected to be encountered, the actual risk during transportation is expected to be very low. Direct exposure from a truck passing through a neighborhood would be literally undetectable as the radiation emitted from the radioactive material is expected to be very low. The dust from the trucks is easily controlled by using complete containment systems similar to the ones in use at the Hanford site. The waste sites at Hanford ship hundreds of trucks per day with no dust emitted. Hanford is a very arid site and dust control is a major issue. The trucks at Hanford are lined and the waste is completely enclosed before it is shipped. There is also the option of shipping the radiological waste by rail car.

There was a concern raised about dust control during the remediation of the landfill. This can be accomplished using engineering controls and standard excavation and sorting practices. As mentioned above, dust control at Hanford is a major concern, and some high hazard remediation has been accomplished using dust controls. There is also the option of using a large containment tent over the site to control all emissions. This technology has been used successfully at the DOE site in Idaho.

Dust control will be a significant issue during removal and remediation of the interim cap. Engineering controls will need to be in place to ensure the emissions are kept as low as possible.

Conclusion: Although there is a risk to any remediation activity, the radiological risk from removal of the landfill is able to be mitigated and controlled to an acceptable level should removal of the landfill be chosen as an option.

In summary, in my opinion, the proposed remedy as outlined in the draft record of decision is technically defensible and is protective of the workers, the public and the environment. Please feel free to contact me at 509-942-3639 or sbump@moellerinc.com with any questions regarding the content of these comments.

Sincerely,

Stephen L. Bump, CHP, CIH, PMP
Deputy Chief Operating Officer
Dade Moeller & Associates